B.E. CHEMICAL ENGINEERING SECOND YEAR FIRST SEMESTER (OLD) EXAMINATION 2019

MACHINE DESIGN AND DRAWING

Time: **Three hours**   Full Marks: **100**

Missing data, if any, are to be reasonably chosen.
Give sketches wherever applicable.
Answer any **Four (4)** questions

1. a) Design and draw a knuckle joint subjected to an axial tensile load of 100 kN. Use plain carbon steel (σ_{yt} =340 N/mm^2) for all components and chose an appropriate factor of safety. b) Discuss maximum shear stress theory and maximum principal stress theory.   *[20+05]*

2. a) Design and draw a protective type rigid shaft coupling to transmit a rated load of 93 kW at 750 rpm. Also the shaft is subjected to a bending moment of 150 N-m. Allowable shear and crushing stresses in the shaft and key are 60 N/mm^2 and 115 N/mm^2 respectively. Allowable shear stress of the coupling bolt material is 56 N/mm^2 and allowable shear stress of CI flange is 62 N/mm^2. b) What is/are the functions(s) of protective flange? c) Why spigot and recess are provided in rigid shaft coupling?   *[20+02+03]*

3. a) What is endurance limit? b) How is it determined? c) What is corrected endurance limit? d) What are the factors that affect the endurance limit? e) What is Miner's rule? f) A rotating shaft made of C45 plain carbon steel (tensile strength 630 MPa) is subjected to a completely reversed bending stress. The corrected endurance limit of the bar is 315 MPa. Calculate the fatigue strength of the bar for a life of 90,000 cycles.   *[02+04+02+03+04+10]*

4. a) Discuss the design procedure to calculate the nominal diameter of the bolt in a bracket which is subjected to an eccentric loading and the line of action of the force is perpendicular to the bolt axis. b) What is hot riveting and cold riveting operation and which one is preferred and why? c) Define nominal diameter, major diameter, core diameter, pitch and lead in connection with a screw thread. d) What are different stresses developed during initial tightening of bolts.   *[08+(03+03)+05+06]*

5. a) Deduce the expressions for different stresses in a thick walled cylindrical pressure vessel subjected to an internal pressure. b) Deduce the expression for belt tensions with the coefficient of friction and angle of wrap in a flat belt drive. c) What is stress concentration?   *[12+10+03]*